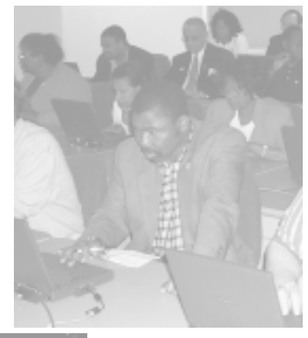
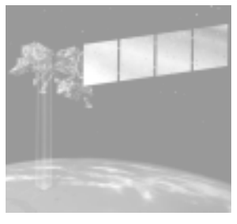
MU-SPIN

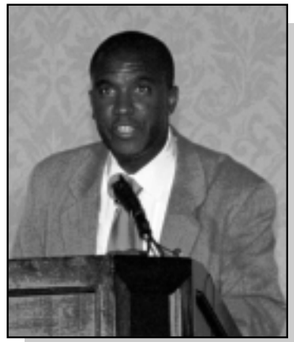
Minority University-SPace Interdisciplinary Network





“Advancing Minority Scholastic Programs to Benefit NASA’s Mission”

http://muspin.gsfc.nasa.gov



James Harrington, MU-SPIN Project Manager, GSFC, 2000 Annual Conference.

Introduction

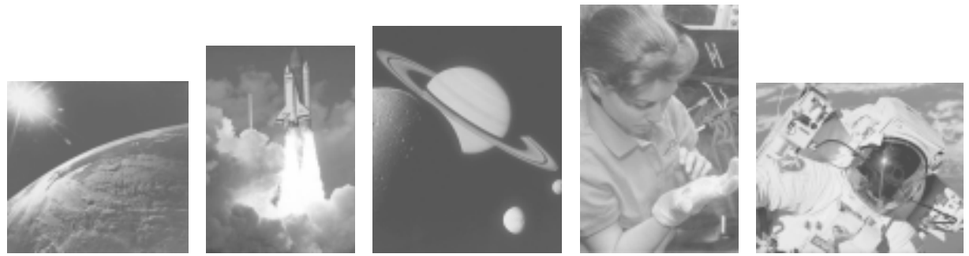
To help train the next generation of NASA's minority scientists and engineers, NASA created the Minority-University SPace Interdisciplinary Network (MU-SPIN). MU-SPIN was started in 1991 by NASA's Office of Equal Opportunity Programs and has remained a highly effective tool as it has continually grown and evolved over the past decade. The program serves America's Historically Black Colleges and Universities (HBCU's), and Other Minority Universities (OMU's). OMU's include Hispanic Serving Institutes and Tribal Colleges and Universities.

The first step for the MU-SPIN program was to help provide campuses and schools with network infrastructure. MU-SPIN recognized the need to provide access to the Internet—the world of electronic information exchange and the sharing of educational resources. MU-SPIN helped minority schools buy and even build their own computers for the classroom.

In MU-SPIN's next phase, the program established regional hubs to help extend its program to an even larger minority community. To do this, NASA established Network Resources and Training Sites (NRTS). With the NRTS, the program expanded, targeting students from kindergarten through college, faculty, administrators and community members.

With the infrastructure and regional hubs in place, MU-SPIN established Expert Institutes. These institutes help foster scientific curriculum development and research with the goal of increasing participation in NASA-related science.

To further expand its reach, MU-SPIN created the Institutes for Collaborative Research and Education (ICRE) model. This approach facilitates leadership of current partners and encourages involvement of new partners.



NASA's Strategic Enterprises

NASA's program, as outlined in the agency's strategic plan, comprises five strategic Enterprises. Each enterprise covers a major area of the Agency's research and development efforts. MU-SPIN's goal is to contribute to research in all five NASA Enterprises.

Earth Science Enterprise Mission:

To use the unique vantage point of space to gain information about Earth's environment that is obtainable in no other way. In concert with research and industry partners, the Enterprise is developing the understanding needed to support the complex environmental policy and economic decisions that lie ahead.

Aerospace Technology Enterprise Mission:

To pioneer the identification, development, verification, transfer, application, and commercialization of high-payoff aeronautics and space transportation technologies.

Space Science Enterprise Mission:

To solve mysteries of the universe, explore the solar system, discover planets around other stars, search for life beyond Earth from origins to destiny, chart the evolution of the Universe, and understand its galaxies, stars, planets, and life.

Biological and Physical Research Enterprise Mission:

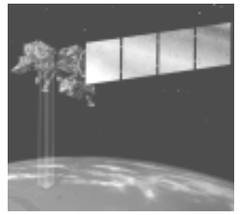
To conduct basic and applied research to support human exploration of space and to take advantage of the space environment as a laboratory for scientific, technological, and commercial research.

Human Exploration & Development of Space Enterprise Mission:

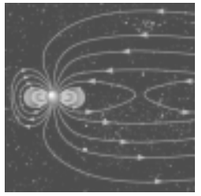
To open the space frontier by exploring, using and enabling the development of space and to expand the human experience into the far reaches of space.

Hubble Space Telescope

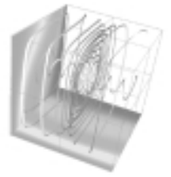
Mercury



Landsat



Earth's magnetic field



Fluid motion under micro-gravity

Examples of NASA Programs with MU-SPIN Involvement

- The **Landsat** series of satellites are used to acquire images of Earth's land surface and coastal regions. Disciplines include agriculture, land use and mapping, geology, hydrology, coastal resources, and environmental science.

  Landsat images of New York City are used to study the impact of urbanization over time. These images play a vital role in Earth science curriculum development at minority schools, grades 3-8.

- **Hubble Space Telescope** (HST) studies include the investigation of extreme environments, the role of dark and luminous matter in determining the geometry and fate of the Universe, the dynamic and chemical evolution of galaxies and stars, and the exchange of matter and energy among stars and the interstellar medium.

  The expertise gained by studying HST data enables students to perform break-through research at space science laboratories.

- **MESSENGER,** NASA's MErcury Surface, Space ENvironment, GEochemistry and Ranging mission to orbit Mercury, is scheduled for launch in March 2004. Our least explored terrestrial planet is key to understanding the evolution of the inner solar system. MESSENGER educational outreach program provides opportunities for MU-SPIN faculty and students to contribute to engineering, data analysis, and science investigations.

- **The Sun-Earth Connection Program** includes the study of solar variability, wind, and surface events, solar interactions with Earth's atmosphere and space environment, and the impact of space weather on human endeavors.

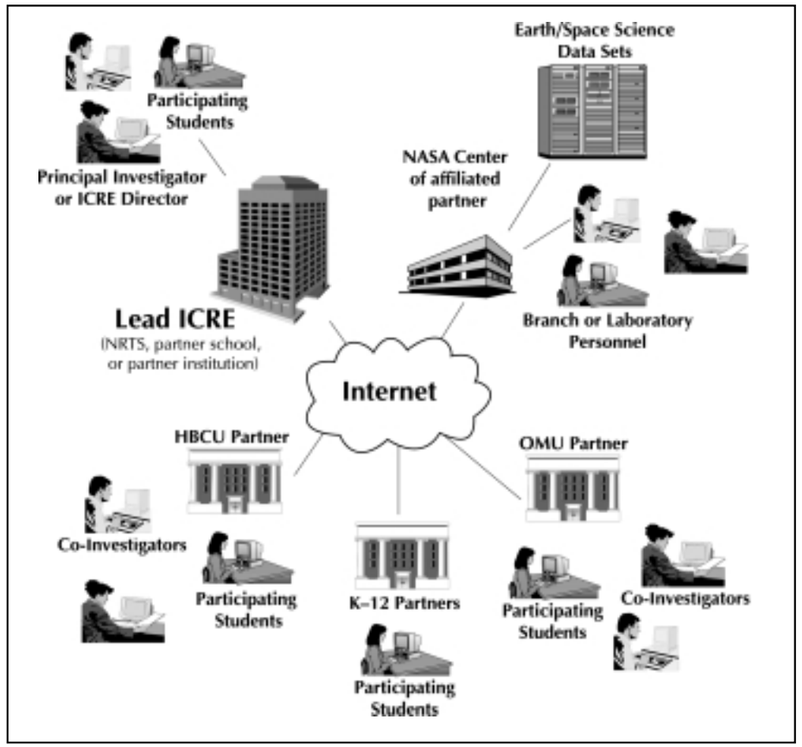
  The expertise gained by participating in MU-SPIN solar physics institutes enables students to perform graduate research at space science laboratories.

- **Microgravity** research concerns the fundamental states of matter—solids, liquids, and gases—and the forces that affect them. In microgravity, researchers isolate and study the influence of gravity on physical processes, as well as phenomena masked by gravity. The microgravity environment of the orbiting space shuttle is a major topic of NASA research in this area.

  MU-SPIN supports joint research in microgravity between NASA laboratories and MU-SPIN universities.

The ICRE Concept

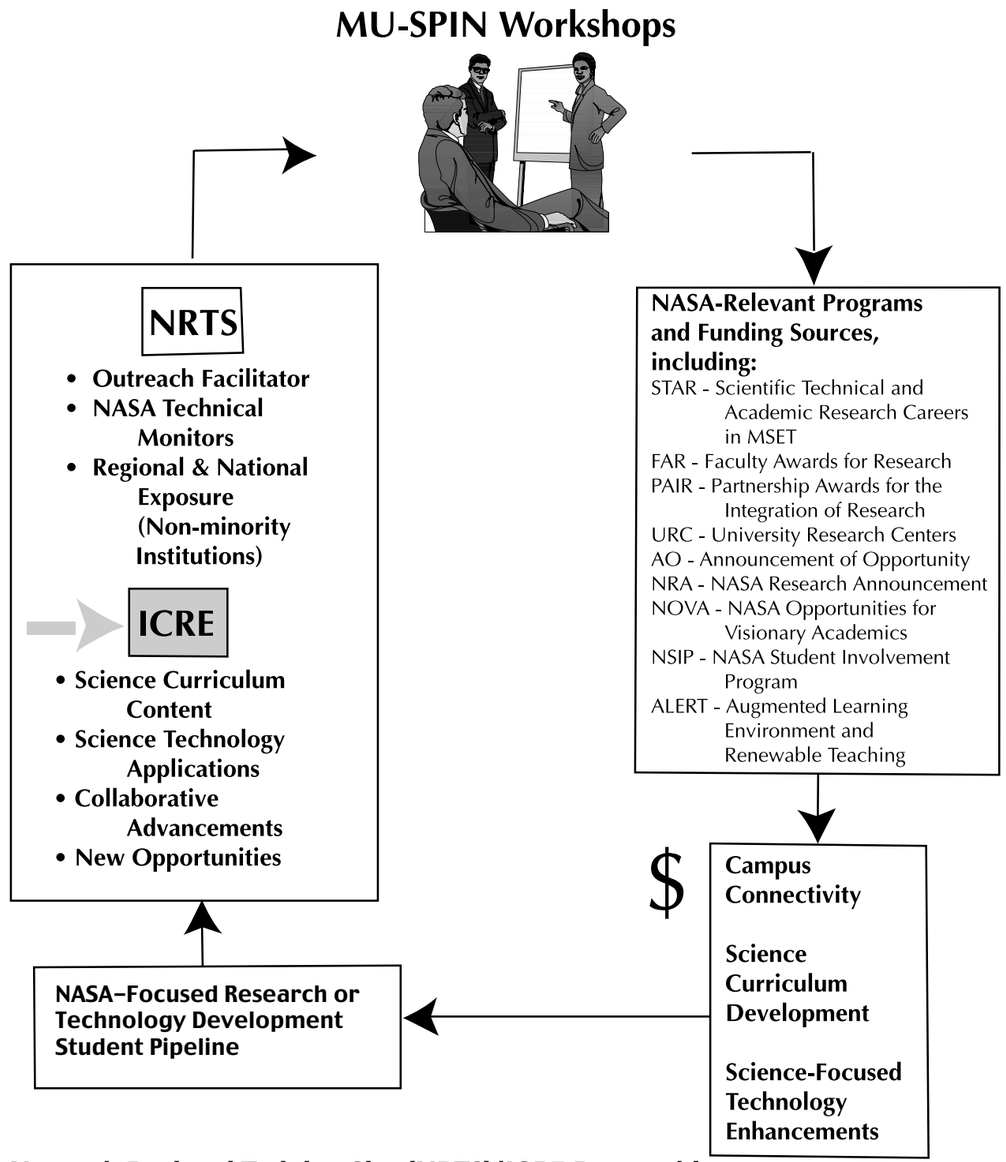
MU-SPIN promotes NASA science and technology in minority schools through the Institutes for Collaborative Research and Education (ICRE) in co-orporation with the Network Resources and Training Sites (NRTS). Targeted workshops are a major component of MU-SPIN's approach.



Institutes for Collaborative Research and Education (ICRE) model.

MU-SPIN's working ICRE model performs the following functions as a virtual institute:

- Performs collaborative research in NASA-related activities,
- Includes a minimum of two HBCU's or OMU's,
- Assists in coordination and provides content to a minimum of two NRTS academic-year workshops on NASA collaborative science and technology.



Network Regional Training Site (NRTS)/ICRE Partnership

To increase minority participation in NASA Programs, MU-SPIN's NRTS/ICRE partnership focuses on the following:

- Continues telecommunications technology support to the underserved,
- Increases participation by requiring new NASA affiliations,
- Delivers curriculum content through new activities with NASA partners,
- Improves project relevancy driven by new NRTS and ICRE activities.

Workshops

MU-SPIN requires each NRTS to hold spring and fall workshops ranging from implementing and using computer networking to writing competitive research proposals. Through the NRTS/ICRE partnership, funding requirements are identified for new opportunities.

Each NRTS has a focus area in science or technology. The following multidisciplinary workshops in the focus areas increase collaboration and participation in NASA's mission:

Campus Technology
- Cabling
- Routing
- Addressing
- Distance Learning

Education Methods
- Innovation
- Content

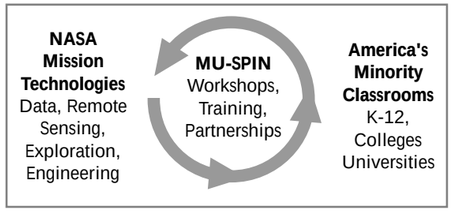
Proposal Development
- Writing
- Announcement Evaluation
- Team Building

Education Technology
- On-line Curriculum
- Asynchronous Communications
- Cache Servers
- Digital Libraries

Science Curriculum Content
- Data Access
- Skills Development
- Student Learning Styles
- Data Visualization

Earth and Space Science Research
- Science Themes and Objectives
- Current NASA Missions
- Announcement Evaluation
- Latest Developments

Highlights from MU-SPIN Collaborations



MU-SPIN advances minority scholastic programs to benefit NASA's mission.

MU-SPIN and its partners use the interest of NASA science to excite students in learning the basics of research in science and technology. In a two-fold approach, MU-SPIN brings NASA science into the classroom and to increase minority research in NASA-related fields.

NASA Science Benefits the Classroom

The following examples depict MU-SPIN's ICRE concept that brings NASA science into the classroom:

- The Morgan State University (MSU) NRTS's Academic Grant Competition is targeted at K-12 projects. Schools apply for funding for software, hardware, or materials to implement proposed science projects.

- Baltimore's Southern High School students are venturing into state-of-the-art bioscience research. They are collaborating with microbiologists from the Center for Marine Biotechnology at the Baltimore Columbus Center using MU-SPIN's computer technology and internet access.

- The MSU NRTS implemented the National Technical Association's 3T Mentor Program, Technologists mentoring Teachers and Targeted students. 3T helps grades 4-12 students learn the skills necessary to pursue college and university courses in mathematics and science. 3T enables teachers to update their knowledge of disciplinary content, improve their science teaching skills, and interact with professional scientists, mathematicians, and engineers.

- MSU NRTS hosts the Adventures in Supercomputing program to train teachers to develop research projects for students to run on the University's Cray Supercomputer.

- Using hands-on and group activities, such as teamwork and presentations, the Canutillo Rocket Program in El Paso, Texas, targets middle school students. Modules include constructing a simple altitude tracker and building water rockets to introduce the principles of flight and launch technology. An introduction to space-program careers explains the requirements for entering science-related fields.

- At the University of Texas at El Paso, one workshop teaches eighth graders to build web pages for their science projects. Another has become an international event, drawing over 300 teachers from around the world to learn web-based educational technology.

- The Explorers of the Universe program is a scientific literacy project based at Tennessee State University (TSU). It is designed to stimulate interest in Earth and space science within middle, secondary, and post-secondary schools.

Teachers, university educators, community members, and practicing scientists use Explorers' research management tools to help students learn the science research process.

Through the Explorers program, scientists at TSU and NASA's Goddard Space Flight Center team with students at high schools across the country. Students participate in NASA- and National Science Foundation-sponsored research.

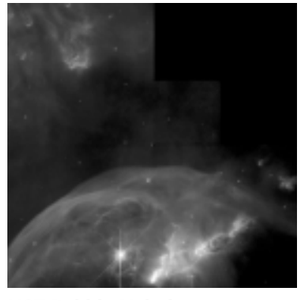
TSU is expanding the Explorers program to support the New Mexico High School Supercomputing Challenge with project management tools. In the Challenge program, teams of students and sponsoring teachers are paired with researchers to define and work on supercomputer projects.

Minority Scholastics Benefit NASA Science

The following depicts MU-SPIN's ICRE concept for returning minority scholastic abilities to NASA. These programs all strive to engage students in research using professional resources and actual data. To develop the communication skills necessary to succeed in science, students give written and oral presentations and complete research posters and projects.

Astronomy and Astrophysics

- South Carolina State University (SCSU) conducts an 8-week residential course of study in astrophysics for minority students. The goals of the program are to motivate students to choose careers in astrophysics and the space sciences.



HST Bubble Nebulae

An introduction to astronomy includes an overview of the solar system, stellar, galactic, and extragalactic astronomy and cosmology, instrumentation, and the HST.

Students process astronomical images using both PC-based software and professional astronomical image processing software. Additional experiences include observing sessions under a dark sky using telescopes, hands-on use of charge couple devices and computer interfaces, working sessions in the SCSU planetarium, and tours of observatories in Arizona and New Mexico.

Collaborators include NRTS at CCNY, ECSU, MSU, Prairie View A&M University, TSU, UTEP, the Science and Mathematics Division of the University of the Virgin Islands, and the Department of Astronomy at New Mexico State University.

- To further TSU space science education, TSU provides streaming video astronomy courses and supports research of the NASA University Research Center for Automated Space Science (CASS).

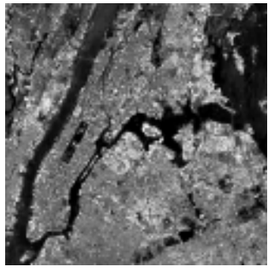
  CASS provides a dynamic research setting for faculty and minority students in NASA-related astronomical research. CASS operates and is expanding an astronomical observatory in the mountains of southern Arizona. Because the telescopes are completely automated, observations cost less and are more flexible. MU-SPIN/NRTS provide funding and staff for technical support.

  As a result of its successful programs, TSU has reactivated its astronomy curriculum and is now offering a minor in that discipline. These courses use NASA data and TSU's interactive electronic network to support research in astronomy and recruitment in technical fields.

Atmospheric Research

- The New York metropolitan area is home to some of the world's most diverse weather, such as winter's cold waves and extra-tropical cyclones. New York's weather is profoundly influenced by the ocean and by the city's enormous output of heat and pollutants.

  To support research and education in this arena, CCNY's Weather Project created METNET (METropolitan NETwork), a MUSPIN-funded network of weather stations at over 30 high schools and colleges in New York's metropolitan area.



Landsat image of New York City

The project works in cooperation with Weather Access Corporation and the National Weather Service. METNET provided the first highly detailed datasets on local weather features in the New York metropolitan area. These datasets are still in use today.

METNET provides an unprecedented opportunity for performing original research on local and small-scale weather features.

The educational component of METNET helps stimulate Earth Science education by providing teachers and students with the opportunity to integrate weather research into the basic Earth science curriculum. The project includes installation of weather stations, teacher-training workshops, and a summer program for teachers and high school students.

The weather projects use METNET surface weather data in conjunction with other standard weather data sources such as surface- and upper-air weather maps, radar scans, and satellite images to study long-term weather trends.

Environmental Science

- In 1975, ECSU acquired 639 acres of land in the Great Dismal Swamp from the Department of Health, Education and Welfare. Because the property is surrounded by a large buffer zone of swamp, it is an unspoiled area well protected from the effects of human activities. Without the wetlands there would be no fishing industry in Albemarle or Pamlico Sounds.

Great Dismal Swamp: Dying Trees

The property is used by ECSU and other organizations to enable research of a pristine wetlands environment, as well as to promote public awareness of the crucial role played by wetlands in the coastal plain biome.

ECSU's Earth System Science Academy focuses on water quality and integrates environmental topics into hands-on learning activities that can be used in social studies, science, and mathematics studies. The Academy gives annual tours of the 1/2-mile-long boardwalk and observation tower.

Under the Mathematics of the Dismal Swamp Project, ECSU professors use swamp research to develop courses that incorporate wetlands applications. This project is sponsored by NASA's Earth Science Enterprise Education Program, ECSU, and MU-SPIN.

- UTEP partners with the Center for Spatial Analysis and Remote Sensing at California State University-Los Angeles to conduct courses on the Geographic Information Systems (GIS). These courses give student researchers access to state-of-the-art GIS services, from data collection to database development and analysis. The Hoopa Reservation in Northern California uses this project to manage timber, save spotted owl habitats, and clean up pollution.

Northern Spotted Owl

Solar Physics

- With the acquisition of a telescope, PVAMU established the Prairie View Solar Observatory, and with it, a new solar physics program. Students make daily observations, use solar observation instrumentation, and receive education related to solar observation and research. Included are the study of solar flares and prominences, their relation to coronal mass ejections, and the establishment of a solar observational data center.

PVAMU's Observatory Program strives to increase the numbers of students in the observational team, and to arrange solar observations from sunrise to sunset, 7 days a week.

The research program has three components: the first involves closely monitoring the most active solar regions for eruptions and flaring events. The second is the long-term evolutionary study of active regions. The third is the study of quiescent filaments, which are long, sheet-like prominences nearly vertical to the solar surface.

Telescope at PVAMU

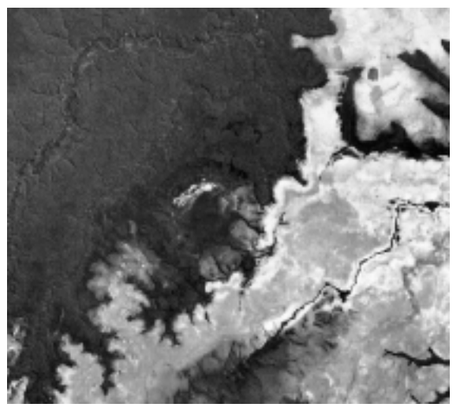
PVAMU plans to conduct a summer workshop, add a class on solar observations to the University's curriculum, host programs for local school teachers, and train graduate students. A weather station will be erected near the telescope, providing real-time weather data to the community through a local television station.

Science in Bolivia

- MU-SPIN schools are taking on a new challenge. In perhaps the remotest and wildest part of the Bolivian lowlands, in an area hundreds of kilometers from the closest town, NASA scientists have identified what they believe to be a complex meteorite impact crater. The crater was originally identified in the mid-1980s from satellite imagery, but an attempt to visit the site in 1987 was unsuccessful, while a 1998 expedition gathered field data that supports the crater impact hypothesis.

  Based on what is known about the geology of the region, scientists believe the meteorite slammed into the Earth sometime between 5,000 and 20,000 years ago, making it our planet's the youngest "large" impact crater. The crater is approximately 8 km across and could have been produced by the impact of a meteorite about 200 meters in diameter. The impact would have released the energy of approximately 500 to 1000 megatons of TNT.

  Scientists plan to return to the site to collect data for further investigation and research. MU-SPIN high school teachers will be members of the three research teams - Magnetism and Gravity, Soils, and Crater Phenomenon. MU-SPIN students will be involved with the teachers in the analyzing the data and the excitement of confirming the origin of the crater.



Meteorite impact crater identified in Bolivia

History of Winter 2002

- HOW is a professional development program for high school teachers. Science teachers from Maine to West Virginia will collaborate with scientists to study snow and ice to understand the annual history of winter.

  The first critical step is to identify the snowflake properties of the east-coast storms and discover the latitude variation. One team, the Snowflake Team, will collect snowflakes and identify the types of crystal formations. This data will be used to compare atmospheric conditions for different storms and describe the type of snow for each of the storms.

  Teachers on the second team, the Snow and Ice Team, will spend a week at Lake Placid to expand the study by characterizing snow on the ground and lake ice. They will attend lectures, collect ice samples from Cascade Lake, and snow samples from a snow pit for their study. As a result of the Lake Placid experience, they will be prepared for training other teachers in the scientific method.

Acronyms

ALERT	Augmented Learning Environment and Renewable Teaching
AO	Announcement of Opportunity
CCNY	City College of New York
ECSU	Elizabeth City State University
FAR	Faculty Awards for Research
GSFC	NASA/Goddard Space Flight Center
HBCU	Historically Black College and University
MSET	Mathematics, Science, Engineering, and Technology
MSU	Morgan State University
NASA	National Aeronautics and Space Administration
NOVA	NASA Opportunities for Visionary Academics
NRA	NASA Research Announcement
NRTS	Network Resources and Training Site
NSIP	NASA Student Involvement Program
OMU	Other Minority University
PAIR	Partnership Awards for the Integration of Research
PVAMU	Prairie View A&M University
SCSU	South Carolina State University
STAR	Scientific Technical and Academic Research Careers in MSET
STScI	Space Telescope Science Institute
TSU	Tennessee State University
URC	University Research Centers
UTEP	University of Texas at El Paso

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